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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/516,482	03/01/2000	Joseph M. DeSimone	5051-4601P	3128

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EXAMINER
BISSETT, MELANIE D

ART UNIT	PAPER NUMBER
1711	21

DATE MAILED: 06/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

A9-21

Office Action Summary	Application No.	Applicant(s)	
	09/516,482	DESIMONE ET AL.	
	Examiner	Art Unit	
	Melanie D. Bissett	1711	

-- The MAILING DATE f this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 March 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *24-38,46 and 69-158* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *73-122 and 149-158* is/are allowed.

6)☒ Claim(s) *24-38,46,69-71,123-141 and 143-148* is/are rejected.

7)☒ Claim(s) *72 and 142* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 July 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. The rejections based on 35 USC 103 using Humphrey, Jr. et al. have been maintained. Additionally, new rejections based on 35 USC 102 have been included using Humphrey, Jr. et al. The present amendment resolves the issue of new matter raised in the rejection dated 12/23/03, and the double patenting rejection has been withdrawn based on the applicant's amendment.

Drawings

2. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 7/25/02 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 123-124, 126-127, 128-130, 132-136, 139-140, and 143-145 are rejected under 35 U.S.C. 102(e) as being anticipated by Humphrey, Jr. et al.

5. From a prior Office action:

> Humphrey discloses an electrode comprising a porous or foamed polyvinylidene fluoride (col. 4 lines 41-57) stabilized to inhibit crystallization and improve conductivity (col. 7 lines 19-23 and 46-52). Thus, the stabilized PVDF is less crystalline than the initial PVDF. Humphrey teaches the addition of PMMA for increasing adhesion of PVDF to metallic conductors (col. 5 lines 44-49), thus forming a PVDF/PMMA blend. PVDF has been shown as a semi-crystalline polymer by the need for amorphous stabilization, and PMMA is a known amorphous polymer. Supercritical carbon

dioxide is preferred as a blowing agent (col. 9 lines 21-36) for forming open cell foams, where the blowing agent is incorporated into the polymer and allowed to expand. This expansion results from a thermodynamic instability; because the carbon dioxide is incorporated under supercritical conditions, one skilled in the art would clearly envision the expansion resulting from a change in pressure and temperature of the mixture. Also, because the foams contain open cells, one skilled in the art would clearly envision the carbon dioxide venting from the created pores or cells, thus separating from the mixture.

6. The reference does suggest that closed-cell porous foams and foams having both open and closed cells may be formed by the invention (col. 4 lines 53-57), noting that the mobility of electrolyte is increased with an open structure. It is the examiner's position that this suggestion of closed-cell foams of the invention anticipates the applicant's claims. Note also that Humphrey teaches cell diameters of 0.01-100 μm, particularly 0.1-10 μm, and especially 0.1-1.5 μm (col. 4 lines 58-65).

Claim Rejections - 35 USC § 103

7. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claims 123-124, 126-140, and 143-145 are rejected under 35 U.S.C. 103(a) as being unpatentable over Humphrey, Jr. et al.

9. From a prior Office action:

Humphrey discloses an electrode comprising a porous or foamed polyvinylidene fluoride (col. 4 lines 41-57) stabilized to inhibit crystallization and improve conductivity (col. 7 lines 19-23 and 46-52). Thus, the stabilized PVDF is less crystalline than the initial PVDF. Humphrey teaches the addition of PMMA for increasing adhesion of PVDF to metallic conductors (col. 5 lines 44-49), thus forming a PVDF/PMMA blend. PVDF has been shown as a semi-crystalline polymer by the need for amorphous stabilization, and PMMA is a known amorphous polymer. Supercritical carbon dioxide is preferred as a blowing agent (col. 9 lines 21-36) for forming open cell foams, where the blowing agent is incorporated into the polymer and allowed to expand. This expansion results from a thermodynamic instability; because the carbon dioxide is incorporated under supercritical

conditions, one skilled in the art would clearly envision the expansion resulting from a change in pressure and temperature of the mixture. Also, because the foams contain open cells, one skilled in the art would clearly envision the carbon dioxide venting from the created pores or cells, thus separating from the mixture.

However, the reference does not exemplify making porous foamed materials having a plurality of distinct voids. The reference does suggest that closed-cell porous foams and foams having both open and closed cells may be formed by the invention (col. 4 lines 53-57), noting that the mobility of electrolyte is increased with an open structure. One skilled in the art would recognize that including amounts of closed cells in the foams would provide a means for controlling the mobility of electrolyte. It is thus the examiner's position that it would have been prima facie obvious to provide closed cells within the porous structure to control the mobility of the electrolyte and thus control the conductivity of the system.

Humphrey teaches the inhibited crystallization of the PVDF polymers but does not mention a mixture of stabilized PFDF and PMMA as an amorphous blend. Humphrey indicates the conductivity as inversely related to the crystallinity of the PVDF (col. 7 lines 46-52). Therefore, it is the examiner's position that it would have been prima facie obvious to form a polymer blend having any amount of crystallinity to produce a foam with the desired conductivity. Since Humphrey indicates a desire to improve conductivity, it would have been prima facie obvious to form an amorphous blend to increase conductivity.

Humphrey teaches the addition of plasticizers and co-solvents in the invention (col. 8 lines 7-17), modifiers conventionally used to aid in processing by reducing viscosity and improving solubility, respectively. However, the reference does not mention the combination of the additives with the blowing agent. Combining the additives with the blowing agent would prevent the need to combine the additives individually. Thus, it is the examiner's position that it would have been prima facie obvious to add a co-solvent or plasticizer to the blowing agent composition in Humphrey's invention with the expectancy of forming a polymer foam with minimal additions.

Note also that Humphrey teaches cell diameters of 0.01-100 μm, particularly 0.1-10 μm, and especially 0.1-1.5 μm (col. 4 lines 58-65).

10. Claims 24-28, 30-38, 46, 69-70, and 146-148 are rejected under 35 U.S.C. 103(a) as being unpatentable over Humphrey, Jr. et al. in view of Pecsok.

11. From a prior Office action:

Humphrey applies as above, lacking express mention of an extrusion process used for forming PVDF foams. Humphrey discloses a method of heating the polymer, incorporating supercritical carbon dioxide, and expanding the article. Pecsok discloses an extrusion method for PVDF polymers, where PVDF and additives are introduced into a powder blender, melt blended in

a twin screw extruder, and extruded onto a wire. Thus, the mixing of the thermoplastics occurs in a mixing section of an extruder, and the components are melt blended. Because of the conventionality of the melt extrusion method, it is the examiner's position that it would have been prima facie obvious to mix the components of Humphrey's invention in the melt in a mixing section of an extruder with the expectancy of beneficial results.

12. Claim 125 is rejected under 35 U.S.C. 103(a) as being unpatentable over Humphrey, Jr. et al. in view of Boutillier et al.

13. From a prior Office action:

Humphrey applies as above, teaching the use of supercritical carbon dioxide but not liquid carbon dioxide as a blowing agent. Boutillier teaches the conventionality of liquid carbon dioxide as a foaming agent (col. 8 lines 41-51) for vinyl monomers such as vinylidene fluoride (col. 7 lines 55-68). It is thought that liquid carbon dioxide would be more cost effective than supercritical carbon dioxide, since liquid carbon dioxide does not require temperature control and pressurization to the extent that supercritical carbon dioxide requires. It is therefore the examiner's position that it would have been prima facie obvious to use liquid carbon dioxide as a blowing agent in Humphrey's invention to save energy required to keep carbon dioxide in a supercritical state.

14. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Humphrey, Jr. et al. in view of Pecsok as applied to claims 24-28, 30-38, and 46 above, and further in view of Boutillier et al.

15. From a prior Office action:

Humphrey and Pecsok apply as above for the extrusion process, failing to mention the use of liquid carbon dioxide as a blowing agent. The reference van Cleeff applies as above. For the same reasons as stated above, it is the examiner's position that it would have been prima facie obvious to use liquid carbon dioxide as a blowing agent in the composition of Humphrey's invention in an extrusion process with the expectancy of beneficial results. The use of liquid carbon dioxide would serve to save energy required to keep carbon dioxide in a supercritical state.

16. Claims 71 and 141 are rejected under 35 U.S.C. 103(a) as being unpatentable over Humphrey, Jr. et al. in view of Minakata et al.

17. From a prior Office action:

> Humphrey, Jr. et al. applies as above, noting the use of physical blowing agents such as carbon dioxide or comparable blowing agents but failing to mention organic blowing agents (col. 9 lines 21-36). Minikata discloses an electrochemical device using a closed-cell polymer foam, suggesting the use of foamed vinylidene fluoride polymer (col. 14 lines 29-65). Halogen compounds, hydrocarbons, carbon dioxide, and toluene are mentioned as useful and equivalent physical blowing agents, where blowing agent 134a (1,1,1,2-fluoroethane) is specified (col. 15 lines 3-13). It is the examiner's position that it would have been prima facie obvious to choose an equivalent physical blowing agent, such as those taught in Minikata, for use in Humphrey's invention in the expectancy of forming equally improved electrochemical cells.

Allowable Subject Matter

18. Claims 73-122 and 149-158 are allowed.

19. Claims 72 and 142 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

20. The closest prior art, Humphrey, Jr. et al., teaches an electrode comprising a porous or foamed polyvinylidene fluoride stabilized to inhibit crystallization and improve conductivity. Thus, the stabilized PVDF is less crystalline than the initial PVDF. However, the reference does not teach the use of chemical blowing agents in the invention, teaching instead that such blowing agents are undesired. Also, the reference does not teach the applicant's claimed surfactant use in the invention. Therefore, it is the examiner's position that the applicant's claimed chemical blowing agents and surfactants, when used in the applicant's claimed methods, provide a novel and unobvious step over the prior art.

Response to Arguments

21. It is noted that a rejection based on 35 USC 102 using Humphrey, Jr. et al. has been added. Although the examiner has noted that Humphrey, Jr. et al. does not *exemplify* foams having closed cells, the reference still suggests the formation of such in a teaching of the invention. Thus, the reference *as a whole* suggests the formation of foams having closed cells.

22. Regarding the applicant's declaration and argument that the reference only teaches how to make foams having open cells, it is the examiner's position that the reference *as a whole* also suggests formation of foams having closed cells. Also, note that the preference or mention of open-celled foams encompasses those foams having both open and closed cells. It has not been shown that the foams made by the methods of the reference have *only* closed cells, and by the broadest interpretation of the claims, a foam having any plural number of closed cells, though few, would anticipate the applicant's foam having a plurality of distinct void spaces.

23. Regardless, it is the examiner's position that the reference need not exemplify every embodiment of the invention. The embodiments are enabled if one of ordinary skill in the art would know how to reproduce the embodiment. In this case, it is the examiner's position that closed-cell PVDF foams are well-known in the art. See Gupta, Table 5. Gupta suggests many variables and additives conventional in the art of fluoropolymer foams that affect the foaming properties, teaching extrusion methods incorporating physical blowing agents for forming voids where the amount of blowing agent affects void fraction and cell collapse (sections 3.3-4.3). This is similar to

Humphrey, Jr.'s method of incorporating physical blowing agents into the thermoplastic for expansion. Thus, one of ordinary skill in the art would be enabled to form a closed cell foam according to Humphrey, Jr.'s invention by conventional processes.

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